REMARKS/ARGUMENTS

Reconsideration is requested of all rejections based on 35 U.S.C. 103:

Examiner has come up with new grounds on which to base his rejection of our application. He continues to rely on Kraft but does so now in view of Dong et al. (and Chou et al.).

A major point of disagreement between us and examiner has been the question of whether or not the post nitridation anneal disclosed in our application is novel. In this latest rejection examiner notes that Dong teaches a post nitridation anneal in oxygen at a temperature from 900 to 1100 °C at a pressure between 1 and 500 torr for between 10 and 150 seconds. Examiner then argues that, although the anneal time claimed by the present invention is well outside this range, it is still merely a matter of routine optimization by one skilled in the art because our claimed range does not produce a result which is different in kind, and not merely in degree, from the results of the prior art.

We respectfully point out that the result of annealing for the time period claimed by the present invention is in fact qualitatively different from that which results from annealing in the time range taught by Dong. This is because Dong's thermal anneal is what is referred to by practioners of this art as a rapid thermal anneal (RTA). As noted in the attached data sheet for a typical RTA system (supplied by the University of California at Berkeley) an RTA takes place over a much shorter time period than a conventional anneal.

Since, in a conventional annealing oven, it takes 15-20 minutes for the object

being annealed to reach thermal equilibrium (and at least as long to cool down), RTAs require that these times to reach equilibrium be greatly reduced. Consequently, equipment for performing RTAs is substantially more expensive than conventional annealing ovens and there is a limit set to the thermal mass of an object that is being given an RTA.

The reason RTAs and conventional anneals lead to different outcomes is as follows: During a RTA only atoms that have been displaced a short distance from their equilibrium locations in the lattice have time to migrate to these locations. Little or no diffusion can take place during a RTA, Thus, RTAs are widely used following ion implantation, for example, to repair lattice damage induced by the ion bombardment but without changing the doping profile of the structure, as would be the case if diffusion were allowed to occur.

In the context of the present invention, a RTA would serve to repair surface damage caused by nitrogen atoms embedded in it following the RPN step. When a conventional anneal is used, additional structural defects that require time to diffuse away from the nitrogen-oxygen interface can also be repaired.. The fact that we have found this to yield a superior product, despite the fact that some diffusion is allowed to take place, must therefore be regarded as a non-obvious result.

In summary, Dong's use of a RTA, yields a different result from that obtained from use of the anneal step claimed by the present invention. Therefore, Dong's teaching does not anticipate the present invention. In fact, since one skilled in the art would immediately recognize that Dong teaches optional use of a RTA, not a conventional anneal, adoption of Dong's teaching would actually serve as an impediment to achieving the improvements claimed by the present invention.

In light of the above arguments, applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

GEO. O. SAILE & ASSOCIATES
28 Davis Avenue
Poughkeepsie, NY 12603

By 

Stephen B. Ackerman
Reg. No. 37761

Rapid Thermal Annealing with the Heatpulse 210T RTA System

(heatpulse1/heatpulse2)

1.0 Title

A G Associates Rapid Thermal Annealing System – Heatpulse1/ Heatpulse2.

2.0 Purpose

This manual describes the operating procedures for two Heatpulse 210T RTA (Rapid Thermal Annealing) Systems in the Microlab: Heatpulse1/ Heatpulse2. Heatpulse1 is for standard Si process. Heatpulse2 is for GaAs process. They are located in GL2 and share a common gas distribution system.

3.0 Scope

Rapid Thermal Annealing (RTA) is an alternative to standard furnace annealing. Its advantages include short annealing times (from one second to 5 minutes) and precise control of the annealing profile. Operations are controlled by PC's and algorithms from AllWin21 Cooperation. The Heatpulse 210T RTA system consists of an annealing furnace, computer controller and a micro controller. The following gases are available: argon, nitrogen, oxygen, H2 10%/balance N2 ("forming gas").

N.B.

4.0 Applicable Documents

4.1 Chapter 5.33 (Heatpulse3)

4.2 Heatpulse 210T RTA System application manuals are available in the Microlab office and by the heatpulses.

4.3 "On line Help and Manual" on the RTA program main menu displays on the computer screen.

5.0 Definitions & Process Terminology

5.1 Recipe

A recipe is a series of steps strung together in any combination. A process recipe is created by selecting one step, specifying the parameters for the step, and continuing the process by the selecting the next step.